Claims

What is claimed is:

1. A method for implementing automated electronic package transmission line characteristic impedance verification comprising the steps of:

generating a selected frequency coupled to a transmission line test structure;

measuring an input impedance with an open-circuit termination and a short-circuit termination on said transmission line test structure;

using said input impedance measured value for said open-circuit termination and said short-circuit termination, calculating characteristic impedance; and

comparing said calculated characteristic impedance with threshold values for verifying acceptable electronic package transmission line characteristic impedance.

2. A method for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 1 includes the steps of providing a pair of transmission line test structures respectively implemented at a package level with a open-circuit termination and a short-circuit termination.

3. A method for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 2 wherein the steps of measuring said input impedance with said open-circuit termination and said short-circuit termination for said transmission line test structure includes the steps of providing open-circuit impedance measuring circuitry coupled to one of said pair of transmission line test structures; and providing short-circuit impedance measuring circuitry coupled to another of said pair of transmission line test structures.

4. A method for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 1 includes the steps of providing a single transmission line test structure implemented at a package level and providing open-circuit and short-circuit termination circuitry coupled to said single transmission line test structure.

5. A method for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 4 wherein the steps of measuring said input impedance with said open-circuit termination and said short-circuit termination for said transmission line test structure includes the steps of sequentially providing an open-circuit termination and a short-circuit termination to said single transmission line test structure utilizing said open-circuit and short-circuit termination circuitry.

6. A method for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 1 includes the steps of displaying a pass or fail result responsive to said compared values.

7. Apparatus for implementing automated electronic package transmission line characteristic impedance verification comprising:

a sinusoidal voltage source coupled to a transmission line test structure for generating a selected frequency;

impedance measuring circuitry coupled to said transmission line test structure for measuring an input impedance for an open-circuit termination and a short-circuit termination;

characteristic impedance calculation circuitry coupled to said impedance measuring circuitry for receiving said input impedance measured values with said open-circuit termination and said short-circuit termination for calculating characteristic impedance;

logic circuitry coupled to said characteristic impedance calculation circuitry for comparing said calculated characteristic impedance with threshold values for verifying acceptable electronic package transmission line characteristic impedance; and

said sinusoidal voltage source, said impedance measuring circuitry, said characteristic impedance calculation circuitry, and said logic circuitry being implemented by a single integrated circuit device.

8. Apparatus for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 7 wherein said transmission line test structure includes a pair of transmission line test structures respectively implemented at a package level with a open-circuit termination and a short-circuit termination.

9. Apparatus for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 8 wherein said impedance measuring circuitry includes an open-circuit impedance measuring circuitry coupled to one of said pair of transmission line test structures; and a short-circuit impedance measuring circuitry coupled to another of said pair of transmission line test structures.

10. Apparatus for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 7 wherein said transmission line test structure includes a single transmission line test structure implemented at a package level and an open-circuit and short-circuit termination circuitry coupled to said single transmission line test structure.

11. Apparatus for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 7 includes a display coupled to said logic circuitry for displaying a pass or fail result responsive to said compared values.

12. Apparatus for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 7 wherein said characteristic impedance calculation circuitry calculates said characteristic impedance represented by:

$Z_o = (Z_{sc} \cdot Z_{oc})^{1/2}$

where Z_o represents said calculated characteristic impedance and Z_{oc} and Z_{sc} represent said input impedance measured values for said open-circuit termination and said short-circuit termination.

13. Apparatus for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 7 wherein said logic circuitry compares said calculated characteristic impedance with threshold values for verifying acceptable electronic package transmission line characteristic impedance represented by:

$Z_1 < Z_o < Z_2$

where Z_o represents said calculated characteristic impedance and Z_1, Z_2 represent lower and upper threshold values for an electronic package characteristic impedance specification.

14. Apparatus for implementing automated electronic package transmission line characteristic impedance verification as recited in claim 7 wherein said transmission line test structure represents conductors on a card and said single integrated circuit device is disposed on said card.

15. An electronic unit comprising:

a transmission line test structure; and

a single integrated circuit device for implementing automated electronic package transmission line characteristic impedance verification; said single integrated circuit device including:

a sinusoidal voltage source coupled to said transmission line test structure for generating a selected frequency;

impedance measuring circuitry coupled to said transmission line test structure for measuring an input impedance for an open-circuit termination and a short-circuit termination;

characteristic impedance calculation circuitry coupled to said impedance measuring circuitry for receiving said input impedance measured values with said open-circuit termination and said short-circuit termination for calculating characteristic impedance;

logic circuitry coupled to said characteristic impedance calculation circuitry for comparing said calculated characteristic impedance with threshold values for verifying acceptable electronic package transmission line characteristic impedance.

16. An electronic unit as recited in claim 15 wherein said transmission line test structure represents conductors on a card and said single integrated circuit device is disposed on said card.

17. An electronic unit as recited in claim 15 wherein said transmission line test structure represents conductors on a multi-chip module and said single integrated circuit device is included in said multi-chip module.